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Romanowski

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[54] **PULVERIZER WITH CASTER ROLLER ASSEMBLY**

[75] Inventor: **Chester J. Romanowski**, Carteret, N.J.

[73] Assignee: **Foster Wheeler Energy Corporation**, Livingston, N.J.

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[51] **Int. Cl.**[2] **B02C 15/04**

[52] **U.S. Cl.** **241/117**; 241/118; 241/127

[58] **Field of Search** 241/117, 118, 119, 120, 241/121, 122, 123, 127, 128, 132

[56] **References Cited**

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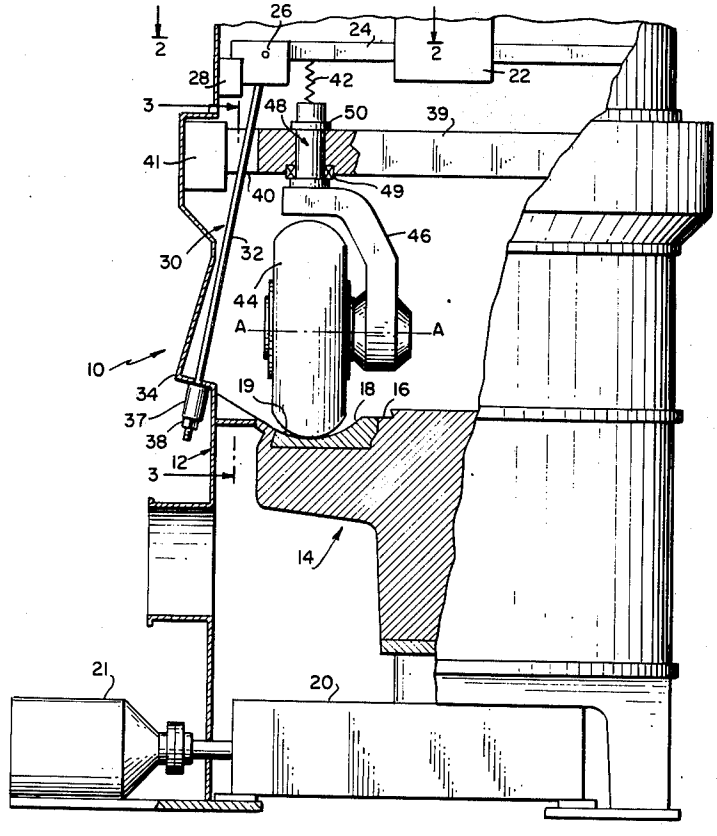
Primary Examiner—Granville Y. Custer, Jr.
Attorney, Agent, or Firm—Marvin A. Naigur; John E. Wilson

[57] **ABSTRACT**

An apparatus is provided for pulverizing material into comminuted particles in which at least three rollers are mounted for rotation and maintained in contact with the material on a grinding ring. The rollers are suspended in a manner to allow the rollers to swivel about respective vertical axes perpendicular to their respective axes of rotation.

8 Claims, 6 Drawing Figures



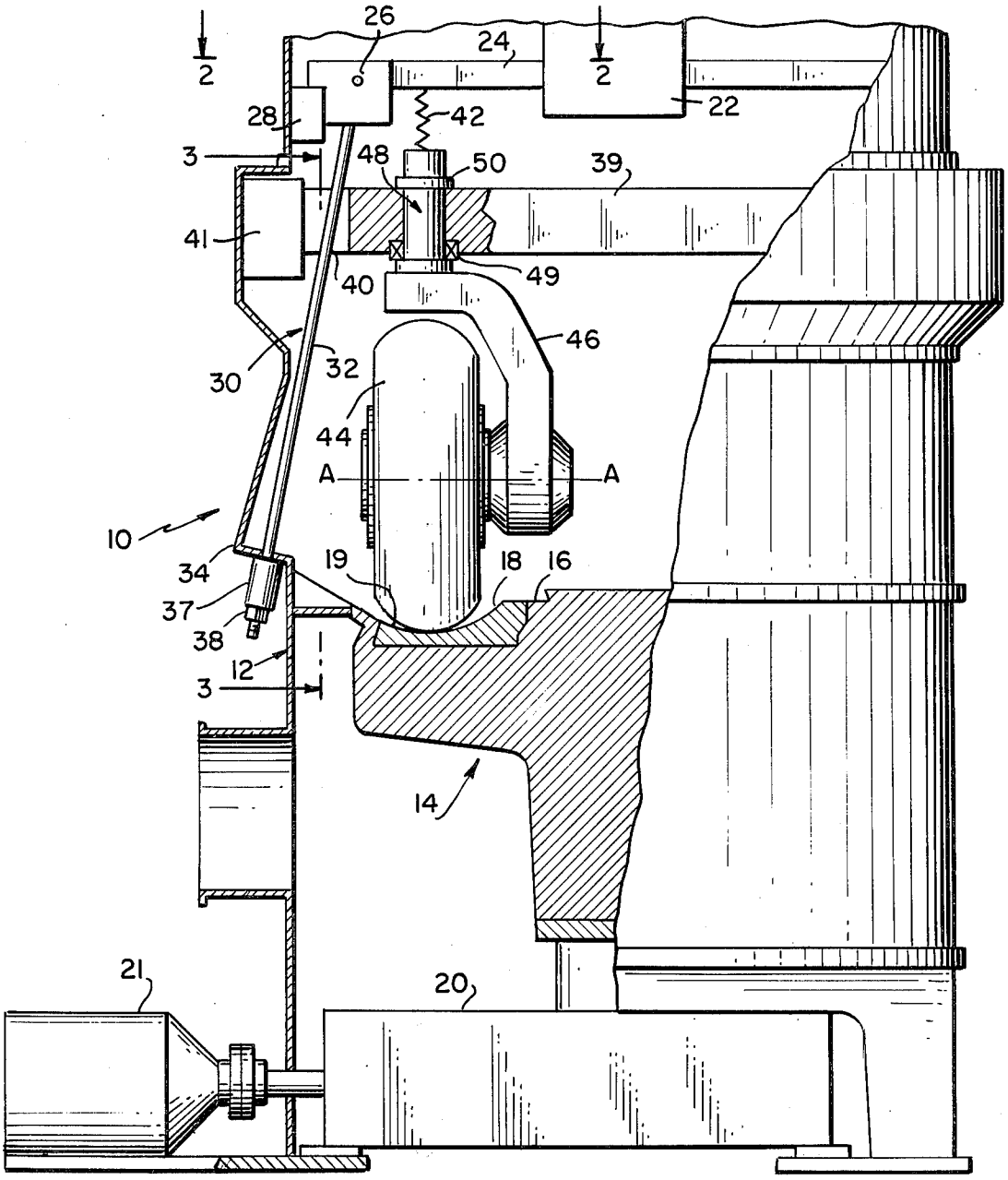

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FIG. 1

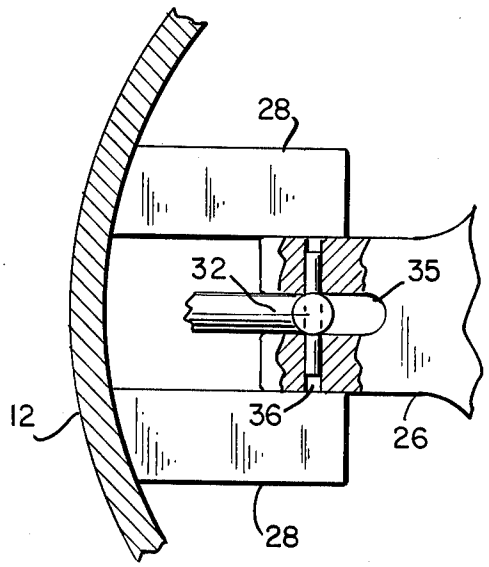


FIG. 2

FIG. 6

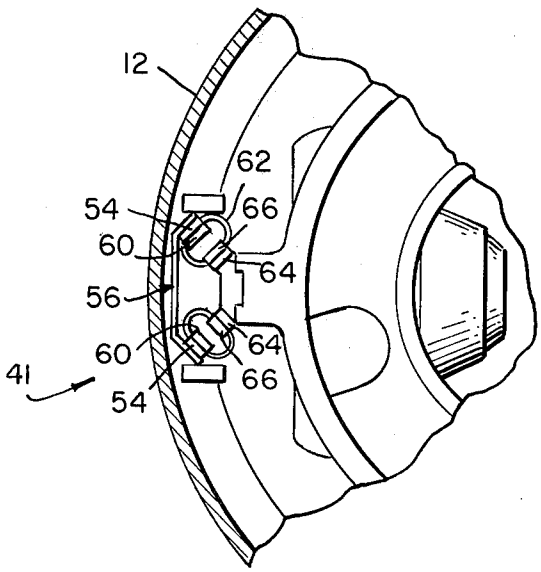


FIG. 4

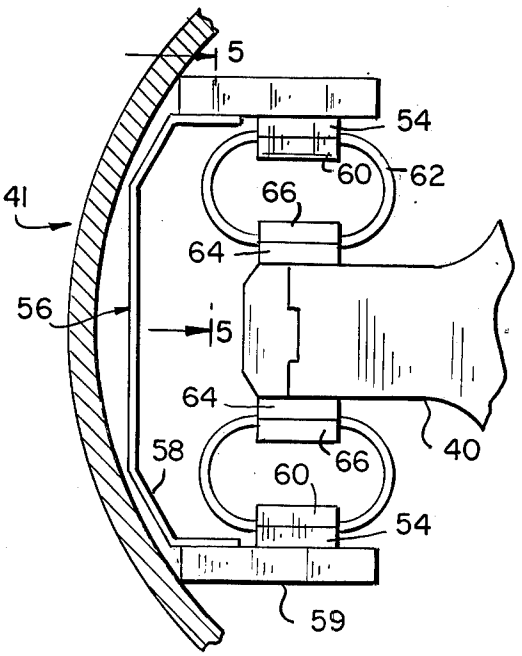


FIG. 3

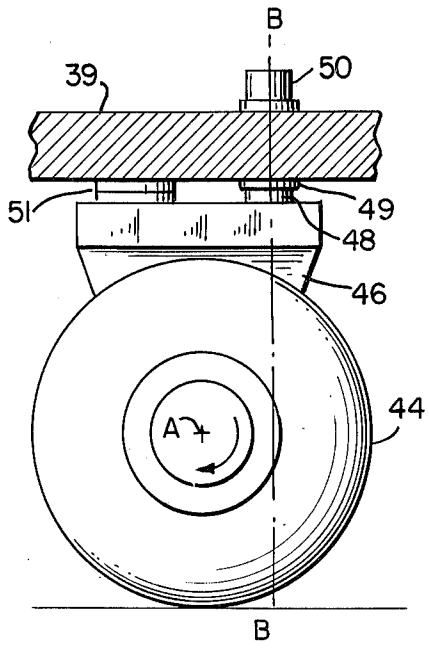
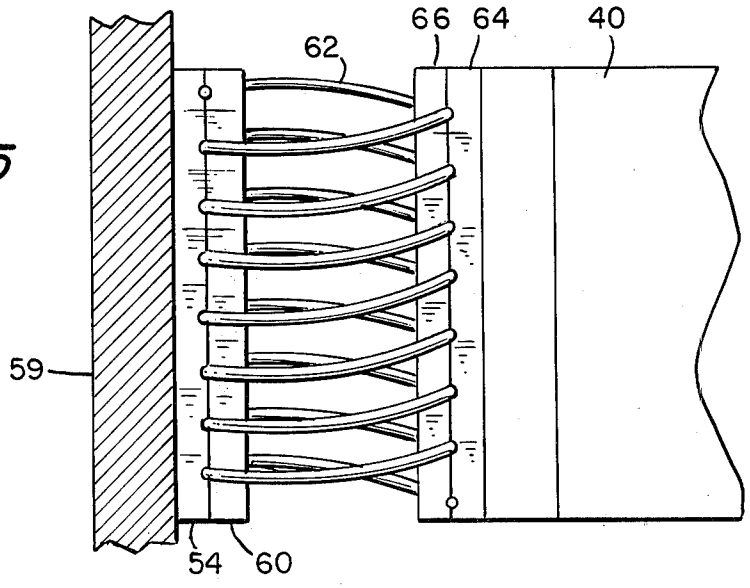


FIG. 5



PULVERIZER WITH CASTER ROLLER ASSEMBLY

BACKGROUND OF THE INVENTION

In connection with the operation of coal-fired furnaces which are used in vapor generating systems in the utility industries for the production of electricity, it is necessary to supply finely powdered coal to the combustion chamber of the furnace. The raw coal feedstock is usually reduced to comminuted particles in a pulverizing apparatus which generally consists of a housing in which is located a rotating grinding table having a grinding ring, and in which relatively heavy rollers are journaled and maintained in contact with the material on the grinding ring.

Various arrangements of pulverizing apparatuses have been used in the past. For example, there have been pulverizers consisting of a plurality of rollers over which a thrust ring was located which applied a downward load to the rollers which would travel in a planetary manner. In such a design the rollers would tend to skid at the point where the pressure ring contacted the roller. Additionally, the ring and rollers would wear as a result of the contact between them.

In another design the rollers were attached to an upper pressure transmitting ring which allowed for vertical movement of the rollers, but did not allow for lateral movement. Such a design subjected the rollers and upper ring to severe stress from vibration.

In a further known design the rollers were attached to an upper pressure transmitting ring which allowed for vertical as well as lateral movement of the rollers by mounting the roller axles on suspension members fulcrumed on the pressure transmitting ring. Such a design restricted the capability of the roller to move around any accumulation of material to be ground since only lateral or vertical movement was provided for.

SUMMARY OF THE INVENTION

In accordance with an illustrative embodiment demonstrating features and advantages of the present invention, there is provided an apparatus for pulverizing material into comminuted particles. A housing is provided in which a rotatable table is mounted. A grinding ring is mounted on the table, and defines a circumferential path on the table. Means are provided for rotating the table. Means are also provided for introducing material into the housing in contact with the grinding ring. At least three rollers are disposed in the housing. Means are provided for supporting the rollers for rotation about respective axes of rotation. Each supporting means includes a shaft which defines a swivel axis lying forward of the axis of rotation of its respective roller.

BRIEF DESCRIPTION OF THE DRAWINGS

The above brief description as well as further objects, features and advantages of the present invention will be more fully appreciated by reference to the following detailed description of the preferred embodiment in accordance with the present invention when taken in connection with the accompanying drawings wherein:

FIG. 1 is an elevational view of a pulverizing apparatus embodying features of the present invention with portions broken away and sectioned to show the location of a roller within the housing of the apparatus;

FIG. 2 is a plan view partially in section taken along line 2—2 of FIG. 1 illustrating upper spring ring projection and guides of the present invention;

FIG. 3 is an elevational view taken along line 3—3 of FIG. 1 showing buffer pads of the instant invention and illustrating the direction of rotation of a roller relative to the support means;

FIG. 4 is a plan view of a part of the caster roller assembly shown in FIG. 1 showing one arrangement of a lower spring ring stabilizer assembly of the present invention;

FIG. 5 is a sectional view of a lower spring ring stabilizer assembly of the present invention taken along line 5—5 of FIG. 4, showing the lower spring ring mounted to the housing; and

FIG. 6 is a plan view similar to that of FIG. 4 with portions shown in section to illustrate an alternative arrangement of a lower spring ring stabilizer assembly of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 of the drawings, there is shown a pulverizing apparatus which is generally designated by the reference numeral **10**. The pulverizing apparatus **10** includes a housing **12** which is mounted at ground level and which defines an enclosure in which is mounted grinding unit **14**. The grinding unit **14** includes a table **16** on which is mounted a removable grinding ring **18** formed with an annular groove **19**. The table **16** is mounted for rotation on a speed reducer **20** and is powered by an electric motor **21**. A conduit **22** is positioned above the grinding unit **14** and is used to introduce raw coal feedstock into the housing **12**.

Within the housing an upper spring ring **24** is centrally disposed with projection **26** located between guides **28** which are mounted to the housing **12**, which is more clearly shown in FIG. 2. While only one projection **26** is shown between guides **28**, it is to be understood that at least three projections **26** are to be utilized which would be maintained within corresponding guides **28**. In this manner, the rotation of upper spring ring **24** is restricted by the guides **28** which are fixed to the housing **12**.

Referring again to FIG. 1, a spring loading assembly **30** is disposed in housing **12** and consists of tension member **32** extending upwardly through a shoulder **34** defined by housing **12** and is secured at its upper end to projection **26** of upper spring ring **24**. As can be better seen in FIG. 2, the projection **26** of upper spring ring **24** is in the form of a clevis having a center slot **35** for receiving the upper end of tension member **32**. A pin **36** extends into both ears of the clevis and through a hole in tension member **32**, thereby securing tension member **32** to projection **26**. It is to be understood that alternative tension members such as cables wrapped over projections **26** may be substituted for the particular tension member described. The lower end of tension member **32** extends through shoulder **34**, then through tensioner **37** and is secured by fastener **38**. Tensioner **37** is in the form of a hydraulic jack which when actuated will move tension member **32** upwardly or downwardly thereby varying the downward force applied to upper spring ring **24** by tension member **32**. Fastener **38** may be in the form of a nut having threads formed therein for receiving a threaded lower end of tension member **32**.

Below the upper spring ring **24** there is disposed a lower spring ring **39** having a projection **40** flexibly

secured to the housing **12** by a stabilizer assembly **41** which will be described later. While only one projection **40** is shown, it is to be understood that at least three projections **40** are to be utilized with each projection **40** being flexibly secured to the housing **12** by a corresponding stabilizer assembly **41**. Spring **42** is disposed between upper spring ring **24** and lower spring ring **39**. In this manner, when tension member **32** is moved downwardly, a downward load is applied to upper spring ring **24** thereby compressing spring **42** which in turn urges lower spring ring **39** downwardly. While only one loading assembly **30** including tension member **32** and spring **42** are shown, it is to be understood that a plurality of each is to be utilized,

A roller **44** is mounted on a bracket **46** for rotation about horizontal axis A—A. Bracket **46** is mounted at its upper end in an opening formed in lower spring ring **39**. The upper end of bracket **46** comprises a vertical shaft **48** which is received in the opening in lower spring ring **39**. A thrust bearing **49** is disposed between the lower ring opening and shaft **48**. Shaft **48** is attached at its top to fastener **50**. In this manner, roller **44** is suspended from lower spring ring **39**, and when ring **39** is urged downwardly by the force transmitted through spring **42**, bracket **46** transmits a downward force to roller **44** thereby urging roller **44** in contact with material to by pulverized on grinding ring **18**.

Referring now to FIG. **3**, it can be seen that the axis of shaft **48** defines a vertical axis B—B disposed forward of the axis of rotation A—A of the roller **44**. It can be appreciated that by having the shaft **48** so disposed, the roller **44** is supported in a caster-like manner. Also shown are buffer pads **51** disposed between bracket **46** and lower spring ring **39**. Buffer pads **51** are utilized to absorb energy transmitted through roller **44** and bracket **46** as a result of the bending moment created by the shock load exerted on roller **44** upon its contacting hard particles in the material to be pulverized.

In FIG. **4** there is shown a stabilizer assembly **41** which is provided to restrict the vertical and rotational movement of lower spring ring **39**. Stabilizer assembly **41** consists of outer bars **54** rigidly secured to a bracket **56** which is in turn rigidly secured to housing **12**. The bracket **56** includes a bent member **58** and straight members **59**. Rigidly secured to outer bars **54**, for example by means of bolts, are inner bars **60**. Both bars **54** and **60** have grooves which are aligned and together define openings for receiving coils of spring **62**. Additional outer bars **64** are disposed opposite bars **54** and are rigidly secured to inner bars **66**. Bars **64** and **66** have grooves which are aligned and together define openings for receiving coils of the spring **62** generally opposite from bars **60** and **64**. Outer bars **64** are rigidly secured to the lower spring ring projection **40**. The alternate stabilizer arrangement shown in FIG. **6** is similar to that of FIGS. **4** and **5** and identical components are referred to by the same reference numerals. Further illustration of the stabilizer assembly is shown in FIG. **5**, wherein the alignment of the grooves in bars **54** and **60** for the receipt of coils of spring **62** is depicted. Also shown is the arrangement of bar **64** which is rigidly secured to projection **40** of lower spring ring **39**.

While only one roller and stabilizer assembly have been illustrated, it is to be understood that at least three rollers and stabilizers are to be utilized. In operation raw coal feedstock is introduced through conduit **22** into the housing **12** and falls to the grinding ring **18**, which is rotated by virtue of the electric motor rotating table **16**. Spring loading assembly **30** applies a downward force to the upper spring ring **24** which transmits a downward force to spring **42** which in turn forces downward on the lower spring ring **39**. Lower spring ring **39** thereafter transmits a downward force through bracket **46** to roller **44** thereby forcing roller **44** to come in contact with the raw coal feedstock on grinding ring **18**. Stabilizer assembly **41** operates to restrict the vertical and rotational movement of lower spring ring **39** after the downward force has been applied to ring **39**. Upon coming in contact with the raw coal feedstock, the friction force created by the rotation of table **16** will cause roller **44** to rotate about its axis A—A. Since roller **44** is pivotably suspended from lower spring ring **39**, it is free to swivel about the axis B—B upon coming in contact with hard material and can move around hard material. Additionally, because lower spring ring **39** is allowed to travel vertically, roller **44** can move upwardly and proceed over hard particles. In the event that a shock load is applied to bracket **46** upon roller **44** coming in contact with hard material, buffer pads **51** absorb the energy transmitted as a result of the bending moment created by the shock load. Since axis B—B is forward of the axis of rotation A—A of the roller **44**, the roller **44** travels in a caster-like manner which allows for better tracking of the roller in groove **19** of the grinding ring **18**. Because of this caster-like movement, roller **44** will return to its normal position after proceeding around hard material.

A latitude of modification, change, and substitution is intended in the foregoing disclosure and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What is claimed is:

1. Apparatus for pulverizing material including hard material into comminuted particles comprising a housing, a rotatable table mounted within said housing, a grinding ring mounted on said table and defining a circumferential path on said table, means for rotating said table, means for introducing said material into said housing in contact with said grinding ring, at least three rollers disposed in said housing, means for mounting said rollers in said housing for rotation about respective axes of rotation, said mounting means including a supporting ring disposed above said roller, a plurality of brackets, each of said rollers being mounted on a respective one of said brackets, and a plurality of shafts, each one of said shafts being connected between said ring and a respective one of said brackets and defining a swivel axis lying forward of the axis of rotation of its respective roller, and means for absorbing a shock load applied to said roller disposed between said brackets and said mounting ring and adapted to allow said rollers to move about said respective swivel axes.

2. Apparatus for pulverizing material according to claim **1** wherein said means for absorbing said shock load comprises a pad attached to the underside of said supporting ring.

3. Apparatus for pulverizing material according to claim **1** wherein said means for absorbing said shock lead comprises pads attached to the tops of said brackets.

4. Apparatus for pulverizing material according to claim **1** in which said means for absorbing said shock load comprises a pad attached to the underside of said

supporting ring, and pads attached to the tops of said brackets.

5. Apparatus for pulverizing material according to claim 1 further including an upper spring ring centrally disposed within said housing and positioned above said supporting ring, a plurality of springs disposed between said upper spring ring and said supporting ring, and means for applying a downward load to said upper spring ring.

6. Apparatus for pulverizing material according to claim 1 in which said axes of rotation are horizontal and said swivel axes are vertical.

7. Apparatus for pulverizing material according to claim 6 in which means are provided for restricting the vertical and horizontal movement of said lower spring ring.

8. Apparatus for pulverizing material according to claim 7 in which means are provided for restricting the rotational movement of said upper spring ring.

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